A Study of *Poecilmitis phosphor* (Trimen) (Lepidoptera : Lycaenidae)

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Ever since its initial discovery by J. H. Bowker roundabout 1864 on the Bashee River, eastern Cape Province, this intriguing and unique species has been the classic Lepidopterist's prize. Few there be that have tracked this brilliant, bronzy-red little copper down in its rain-forest domain. Except perhaps for K. M. Pennington who is fortunate enough to live on its doorstep, this species is definitely one that nobody can confidently expect to see at any particular place or time. Innumerable visits by the author to procure specimens in a spot near Stutterheim, Cape Province, where L. Schroder had the good fortune of netting the first specimen, were quite without result. Then again, one year, when a spot nearby was eventually found that appeared to support a strong colony, no more was seen there again for many subsequent years.

From the time that Bowker caught the first three specimens, all females, in the eastern Cape during the 1860s, a period of over 50 years was to elapse before another specimen was found. This was in 1921 when Higgins caught a female at Eshowe, Natal. However, it was only after another 12 years that the species was found in appreciable numbers when K. M. Pennington discovered a colony in the Methley's garden next to his present home near Balgowan, Natal.

The only species of its kind to inhabit forests, it is evident from observations that the secretiveness of *phosphor* is no doubt attributable to its small size, rapid flight, wariness (especially males) and the strong possibility that it keeps well out of sight by haunting the canopy. Swanepoel and Pennington record them sporting about tree-tops and the author has seen them coming down to settle on roads and then depart again at great speed for the heights. However their speed of flight and smallness make it extremely difficult to tell from just where they come and ultimately spend most of their time. Puddles of water on forest roads, at times, attract specimens, mostly females, and in this position they are quite easy to net but

Plate V. *Bowkeria phosphor* subspecies ×1·95

1 and 2. Uppersides of male (holotype) and female (allotype) *B. p. borealis* resp.

3 and 4. Undersides of male (holotype) and female (allotype) *B. p. borealis* resp.

5 and 6. Uppersides of male (neallotype) and female *B. p. phosphor* resp.

7 and 8. Undersides of male (neallotype) and female *B. p. phosphor* resp.

wandering males are another matter. They suddenly appear, settle for but just a few seconds and then rocket off again to quickly disappear from sight.

There is little doubt that *phosphor* must inhabit many of our eastern montane forests from the east Cape through Natal and up to the Transvaal but up until fairly recently there were only about six spots over this vast stretch where the species had been located. Recent collecting activities have only slightly extended our knowledge of its distribution. In the east Cape we now know of six spots, in Natal three, and in the Transvaal one. Vast tracts occur between known localities. Coastal forests are shunned. Although primarily a true forest dweller it is evident that *phosphor* will on occasions follow watercourses away from the main forest block provided these are reasonably well wooded. Such a situation was encountered personally at the foot of the Amatola mountains near Debe Nek, Eastern Cape, where one April quite a few specimens of *phosphor* were seen playing about along the tree-tops of a narrow fringe of trees bordering a small stream which emerged from a forest about half a mile away. Even more surprising was the capture of a lone specimen near Fort Beaufort which not only represents the most westerly point known to be reached by the species but also indicates just how far *phosphor* may venture away from forests. According to Mr J. C. McMaster, its captor, the nearest forests are on the Katberg mountains about 15 miles away in a northerly direction. Presumably the insect, which was caught on the wooded banks of the Kat River, had wandered down along this watercourse as this river rises in these mountains. That they are attracted to flowers, e.g. bramble, has been shown by both Swanepoel and Pennington—such fortune has not been mine in spite of a profusion of brambles in flower along forest roads through its haunts in the east Cape. At his home near Balgowan Mr K. M. Pennington has also observed *phosphor* visiting the following flowers:— Chrysanthemum, Mesembrianthemum, Dahlia, Blackjacks, and Canary Creeper.

In common with other species of *Poecilimitis*, *phosphor* appears to have a prolonged flight period and has been observed during most months of the year. One male came down to the road near Stutterheim during August when it was clear, but wintery conditions and chilly winds still prevailed.

In keeping with the general dearth of knowledge concerning this butterfly, the early stages and foodplant are likewise unknown. All that is known in this regard is the appearance of the egg which was squeezed from a female (see fig. 1).

TAXONOMIC DISCUSSION

It has long been felt that the generic placing of *phosphor* is unsatisfactory, but, apart from much speculation, no study-based conclusions have been forthcoming which might allocate the species to a more appropriate genus if such exists.

Most workers have seen closest kinship with *Axiocerses*

Hübner but nevertheless still follow general convention in allowing *phosphor* to remain grouped under either *Phasis* Hübner, *Poecilmitis* Butler or *Zeritis* Boisduval. Others have hinted at the possibility of a generic home for *phosphor* in *Chloroselas* Butler, *Desmolycaena* Trimen, *Aphnaeus* Hübner, *Crudaria* Wallengren and even *Deudorix* Hewitson.

Little study was necessary to reject *Axiocerses* as, taking the species *bambana* Grose Smith as an example, it was found that antennae, palpi, venation and genitalia all showed conclusively that there is no affinity to *phosphor* at the generic level whatsoever, bar a resemblance of their tails. Similar

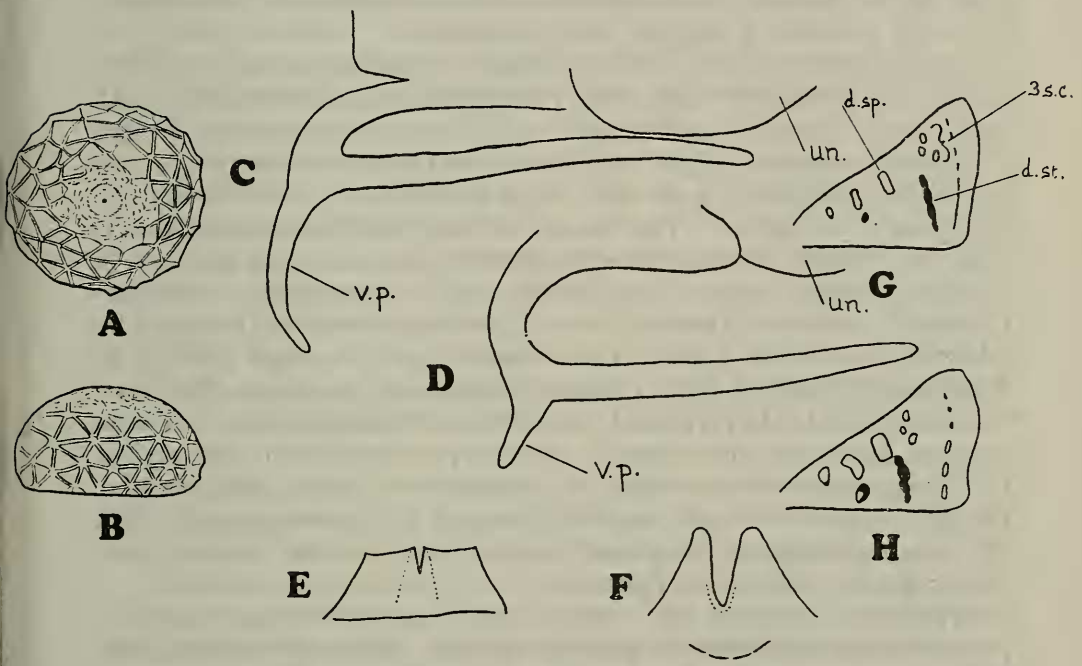

Figure 1. A and B Egg of *B. p. phosphor* (Trimen), 0·79 mm. in height and 0·47 mm. in diameter

A—dorsal view, much enlarged.

B—ventral view, much enlarged.

C, D, E and F—genital structures showing comparison between *B. p. phosphor* (Trimen) and the type-species of *Poecilmitis*, i.e. *P. lycegenes* (Trimen).

C—Subunci of *B. p. phosphor.*

D—Subunci of *P. lycegenes.*

E—Lower fulture or anellus of *P. lycegenes.*

F—Lower fulture or anellus of *B. p. phosphor.*

v.p.=ventral process un.=uncus.

G and H—Forewing undersides of the two subspecies of *B. phosphor*, illustrating different placement of black discal stripe (d. st.) and cluster of three spots (3 s.c.) in relation to the discocellular spot (d. sp.). In *B. p. phosphor* (H) these are positioned more proximally so that the black discal stripe makes contact with the discocellular spot. In *B. p. borealis* (G) both the discal stripe and three-spot cluster are more distally placed. Note also fuller development of spots in *B. p. phosphor.*

studies also made it quite clear that *phosphor* could not be united with any of the other genera mentioned above, excluding *Poecilmitis*. Only when considering the latter genus do we find some definite closer relationship and it was in this connection that more careful study was called for in order to ascertain if *phosphor* was well placed in *Poecilmitis* or whether it should be isolated generically.

The most compelling case for *phosphor's* retention within *Poecilmitis* is the apparent uniformity of the genitalia of the species (*vide* Murray, 1958). However, a little closer study does reveal a few fundamental differences not readily discernible but sufficiently important in my estimation as to consider discrete generic grouping for *phosphor*.

These differences in the genitalia, although small in themselves, do appear of sufficient magnitude when compared with the much smaller differences that serve to separate other *Poecilmitis* species. Figure 1 illustrates the genitalic differences between *phosphor* and the type-species of *Poecilmitis, P. lycegenes* (Trimen). The point to note in this connection is that the shape of the lower fulture in *lycegenes* agrees in essence with other *Poecilmitis* spp., especially *chrysaor* (Trimen), *aethon* (Trimen), etc. The structure of this part in *phosphor* however has no true counterpart in other species of *Poecilmitis* studied, e.g. *thysbe* (Linnaeus), *pyramus* Pennington, *nigricans* (Aurivillius), *lyncurium* (Trimen), etc. These species also have the shorter ventral process to the subunci as in *lycegenes* whereas that of *phosphor* is long and curved. Oddly, *phosphor* is not entirely unique in this respect in that the same process in *chrysaor* is somewhat similar but the subuncus shows other divergences.

However, should the whole case for removing *phosphor* from *Poecilmitis* depend entirely on the extent of dissimilarity of its male genitalia then we could perhaps still harbour suspicions of doubt, but as will be appreciated from what follows, the matter of *phosphor's* generic uniqueness is put beyond question.

1. Antennae conspicuously reddish-tipped from above in males, at least last 4-5 segments—not so in other species, *lycegenes,* etc.
2. Labial palpi. Terminal joint noticeably shorter than in other *Poecilmitis* spp., including *lycegenes.*
3. Wing-shape quite different to *lycegenes,* etc. Whereas in the latter species the outer margins are convex, in *phosphor* they are straight in sections or even concave.
4. The structure and presence of a tail again makes *phosphor* unique when viewed together with other *Poecilmitis* species. The few species that do possess tails have them more rudimentary and of a different character as in the case of *chysaor* where the whole configuration of this structure is different. Thus *chrysaor's* tail is much shorter and clavate while that of *phosphor* is longer well developed, attenuated and acuminate and with a well de-

veloped basal lobe.

5. Wing-pattern. In all *Poecilmitis* species there is a remarkably characteristic and uniform arrangement of the upperside black discal spotting over the reddish-coppery ground colour. This is quite lacking in *phosphor* and although there is in some specimens a greater or lesser development of a sub-marginal row of black spots in the *Hw.* and some *Fw.* discal spotting in some females, these are so different in form, arrangement and position as to appear not to be homologous at all. The unusually wide black border of the *UpFw.*, especially broad in the apical portion of the male, is also a conspicuously unique feature.
6. Early stages. Although only the egg is known this does give some positive indication that *phosphor* is not typical of *Poecilmitis*. Referring to the interesting publication of Clark & Dickson (1956) it will be seen that there is at least one marked difference in the egg sculpture between *phosphor* (see fig. 1) and that of the seven species of *Poecilmitis* figured in this paper. In *Poecilmitis* the egg surface is moulded into rather deep hexagonal identations but in *phosphor* this is developed into a reticular or lacework pattern, the indentations also being far shallower. This egg-pattern of *phosphor* actually places it closer to that of an *Aloeides*, although it also bears some resemblance to *lycegenes* (Clark & Dickson, 1971) but lacks the vertical ribbing.
7. Finally, even in matters of habits and habitat *phosphor* stands alone. In South Africa there is no other case of a copper, let alone a *Poecilmitis* sp., being bound to a forest habitat and, even more odd, favouring the canopy. The extreme wariness of males and especially their tendency not to return to resting spots also marks this species off from its congeners.

Although this discussion has emphasized the points of difference between *phosphor* and the general run of *Poecilmitis* species, the actual placing of *phosphor* in relation to its congeners in a taxonomic table or key certainly puts it easily within the old *Phasis* group of Aurivillius (in Seitz, 1925). In his breakdown of *Phasis*, *phosphor* would conveniently form a third group, i.e. 2(c) to his second major subdivision thus showing closest relationship to *Aloeides* and *Poecilmitis*. Of these two latter genera *phosphor* obviously approximates closer to *Poecilmitis* but nevertheless must have diverged from this genus at a comparatively early stage, while still retaining some visible ties with *Aloeides* as evidenced by the egg sculpture. It is possible that upon taking to a forested habitat *phosphor* became isolated enough to develop other notable differences.

In choosing a generic title for *phosphor* no more appropriate name than *Bowkeria* **gen. nov.** could be suggested as a fitting tribute to the zeal of the intrepid Colonel James Henry Bowker, who discovered this and many other interesting species during

his pioneer, collecting activities about the eastern Cape and Natal. I am indebted to Mr C. G. C. Dickson for proposing this name.

During a recent study of a fair series of specimens of *phosphor* from the Cape, Natal and Transvaal it became obvious that two taxa were involved. Murray did not suspect this when he described a Balgowan male in his book of 1935. As his description of the female (*ibid.*) was only an adaption of Trimen's initial description of the holotype (a female of the nominate subspecies) this left the curious situation of the *borealis* female and *phosphor* male as being as yet undescribed. This defect is remedied herein.

Bowkeria phosphor borealis
ssp. n.

Phasis phosphor (Trimen) Murray, 1935. *South African* Butterflies p. 109 (part.).

Holotype: Male, Yellowwoods, Natal, 24/4/1964 (K. M. Pennington).

Allotype: Female, Balgowan, Natal, 18/4/1943 (K. M. Pennington).

Paratypes: 8 males and 6 females consisting of 2 males and 1 female from near Graskop, Transvaal and the rest from the type locality.

Description of Holotype male: Glittering orange-red with black markings.

FwUp.: Almost half of the distal section is black, especially broad apically, narrowing towards tornus and projecting slightly inwardly along inner-margin. The boundary line between black and orange-red reaches the costa near cell-end where a black marking projects to close the cell.

HwUp: Orange-red, except for a black clouding at base and along inner-edge, a blackish blotch on margin of area 7 and evidence of submarginal black spotting reduced to areas 1, 5 and 6, the spot in area 5 being much smaller than the one in 6. A thin black line borders the outer margin. A lobed tail, tipped white, extends from the tornus.

Un.: Varying shades of ferruginous brown liberally adorned with metallic spots and streaks. Opposite the *Up.* orange-red of the *Fw.* the underside is also similarly coloured, only lighter and not glistening. Also in this area are some black markings and a black discal stripe.

A male specimen of this race is figured in colour by Murray (1935).

Allotype female: Paler, purer orange than male, not so bright; wing shape more obtuse.

FwUp: Basal parts dusky-suffused. Discal areas bear 5 black spots, the one closing the cell the largest and the others grouped into 2 pairs on either side but below discocellular spot, the proximal pair more separated than the distal pair. Cilia orange-suffused along hind-margin clearer from apex and fading towards tornus, also narrowly fringed whitish but this

is only really visible when viewed under a low power lens. Black border not as broad as in males, in the apical area, but somewhat broader towards tornus.

HwUp.: Basal-costal area darker and more extensively dusky-suffused than in *Fw.* or the male *Hw.* This suffusion links up with the submarginal spotting to form a tapering pointed downward curve, as in a half-crescent. Cilia variable.

Underside similar to the male but rather paler throughout.

Distribution: Known only from near Balgowan (e.g. "Yellowwoods" farm), the Karkloof Falls area and from the vicinity of Eshowe in Natal, extending up to the escarpment forests of the eastern Transvaal as at Gaskop.

Remarks: Although this subspecies of *phosphor* has been known since its discovery in Natal in 1921 and 1933 its distinctness was not suspected mainly because the male of the eastern Cape form was not discovered until 1962 when L. Schroder caught one near Stutterheim. In addition, very few females of the latter form were extant and so it was only during 1963 when the author began amassing a goodly number from the neighbourhood of Stutterheim that the differences separating these two subspecies became more clearly apparent.

Transvaal specimens, of which I examined only two males and one female, were found to be identical to Natal examples.

Bowkeria phosphor phosphor (Trimen)
Comb. n.

Zeritis phosphor Trimen. 1864. *Trans. ent. Soc. London* 3 (2): 178 Bashee River, Caffraria.

Neallotype: Male, Stutterheim, Cape Province, 22/8/1964 (C.D. Quickelberge).

Additional material: Six males of which four are from Stutterheim, one from Debe Nek and one from Fort Beaufort; also eight females all from Stutterheim.

Description

Neallatype Male: Glittering reddish-orange with black borders and markings. Differs from the female in much the same way as sexes differ in the above description of *borealis* (see also *Differential Diagnosis*). Cilia whitish-fringed in *Fw.*, brownish in *Hw.*

FwUp.: Discocellular spot large and prominent. Two minute black spots in cell.

HwUp.: Basal black scaling extends as a black suffusion (not altogether obscuring the orange ground-colour) well over discal area nearly to the half-way mark. A faint black line closes the cell. Submarginal row of black spots only absent in areas 2 and 3 although under a lens some faint indication of incipient spotting is visible in the form of dark individual scales in these area, especially in area 2. ...

Un.: Very similar to female except that there is less metallic scaling of the *Hw.* spots, many lacking this feature altogether.

Distribution: Found in the eastern Cape Province in forests covering higher ground i.e. off the coastal strip and stretching from Fort Beaufort through Debe Nek, Stutterheim and Amabele to the Tsomo and Bashee Rivers.

Remarks: Through the kindness of Mr G. E. Tite I was able to examine colour photographs of the holotype female of *phosphor* lodged at the British Museum. An examination of these left no doubt that this specimen is one of the nominate subspecies, thus necessitating the allocation of a new name to the Natal/Transvaal subspecies. Unfortunately the holotype, a female caught by J. H. Bowker near the Bashee River, bears no date of capture but from inference must have been caught between the years 1860 and 1864. It is figured in colour by Trimen (1866).

Owing to the apparent close resemblance between the two subspecies of *phosphor* the following diagnosis was prepared. Much time has been devoted to the study of these two forms and I have no doubt that they constitute two distinct taxa. As often is the case when studying allopatric populations no surety was reached as to whether the two forms were only subspecifically distinct or whether two species were involved. Until more is known about this species and the matter can be studied on a broader basis it was decided that it would be safer to relegate the two taxa to subspecific rank, leaving the way open to elevation to specific rank should evidence for this come to light later. This possibility is by no means remote, the differences appearing to me to be more of specific import.

Differential Diagnosis

Based on 29 specimens altogether, comprising 8 females and 7 males of nominate *phosphor* and 8 males and 6 females of *B. p. borealis*.

Male Up.: In general outline the wing-shape in *borealis* is more angular or acute compared with the squatter, more obtuse lines, of the nominate race. This difference of build is even reflected in the markings or spots, which are narrower and less rounded in *borealis* than those of nominate *phosphor*. This is especially apparent in the markings of the *Un.* but on the upperside the effect is also discernible in the shape of the conspicous black spot closing the cell on the *UpFw.* which in *phosphoris* a prominent spot whereas in *borealis* it is better termed a bold streak. The tails also tend to differ along similar lines in that in *borealis* they are long and straight, not as twisted and short as in the east Cape form.

In general *Up.* appearance *borealis* is a more striking insect due mainly to its crisp, more clear-cut lines. Nominate *phosphor* is by contrast somewhat duller and more blackish-suffused on the *UpHw.* about base, costa and inner margin. On this wing there is also a more extensive development of the submarginal row of black spots in *phosphor* and in one specimen even the veins of the *UpHw.* are suffused with black. In *phosphor* these submarginal spots are usually only absent in

areas 2 and 3, being always present in area 4. *Borealis* usually has spots present only in areas 5 and 6 with a few specimens having them in 4 as well.

Male Un.: The predominant brown coloration is darker and of a somewhat different colour in *borealis,* ranging from ferruginous along the hind-margins of the *Hw.* to lighter tints of the same colour over the rest of the wing. Over these parts *phosphor* is ferruginous on hind-margins, paling to greyish-ochreous elsewhere, sometimes tinged with vinaceous. The spots of *borealis* are more clearly defined and extensively metallic-scaled especially on the *Hw.* where virtually every spot glistens conspicuously. In *phosphor* the spots of the *Hw.* are more diffuse and have no metallic scales except towards the tornus. A few specimens, however, if closely examined have some, but not all, of the discal spots faintly metallic-scaled as well.

Female Up.: In *borealis* the wing shape is, as in the male, more elongate, less square-cut, especially in *Fw.* which also has the outer margin more convex and often less elbowed than in *phosphor.* Also more rounded in *borealis* is the distal margin of the orange ground colour. This margin is often scalloped, this effect being produced by the black of the outer margin penetrating along the veins for short distances. However, this character is variable and only faintly apparent in some specimens which, when like this, are not unlike some of the specimens of *phosphor* which show incipient trends in this direction. Generally, though, *phosphor* lacks any such scalloping.

Tails as in the male *borealis,* i.e. longer and straighter than those of *phosphor.*

On the *UpFw. borealis* very often has at least some indication of black spotting over the orange discal areas besides the ever-present well-marked spot closing the cell. Sometimes there may even be 4 well-developed such spots arranged in two pairs. In *phosphor* this discal spotting is either absent or only faintly visible, never as well-developed as is normal for *borealis.*

Female Un. In the *Fw.* the discal row of black spots forming a stripe from areas 1b to 4 terminate against vein 5 at a position either halfway between discocellular spot and the cluster of three spots situated distally towards apex or, as is most often the case, at a point closer to these three spots than to the discocellular spot (see illustration). In all females of *phosphor* this black discal stripe makes contact at its anterior end with the discocellular spot or, if not, very nearly so.

This tendency towards the bunching up together of the above markings in *phosphor* and the greater spreading out of same in *borealis* is also noticeable in males but is not as easily described or obvious as in females.

Due to insufficient material no thorough examination of a comprehensive series of genitalia dissections of both subspecies has been possible for purposes of comparison. Although

some differences of anellus, valve and uncus shape have been noted this can carry no weight until a greater series can be studied to determine the extent of individual variation in the genitalia of each taxon.

Abbreviations used for wing surfaces are:—*Up.*—upperside; *Un.*—underside; *Fw.* and *Hw.*—fore- and hind-wings; *UpFw.* and *UpHw.*—uppersides of fore- and hind-wings.

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Literature Cited

Clark, G. C. and Dickson, C. G. C. (1956). *J. Ent. Soc. S. Afr.*, **19** (2): 195-215.

Clark, C. G. and Dickson, C. G. C. (1971). *Life Histories of the South African Lycaenid Butterflies.* Cape Town.

Murray, D. P. (1935). *South African Butterflies. A Monograph of the Family Lycaenidae.* London.

Murray, D. P. (1958). *Ann. S. Afr. Mus.* **44** (6): 269-78 (plus 2 plates).

Seitz (Aurivillius, C) (1925). Macrolepidoptera of the World. **13.**

Trimen, Roland (1866). *Rhopalocera Africae Australis*, **II.** Cape Town.

Trimen, Roland (1887). *South African Butterflies*, **II.** London.

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